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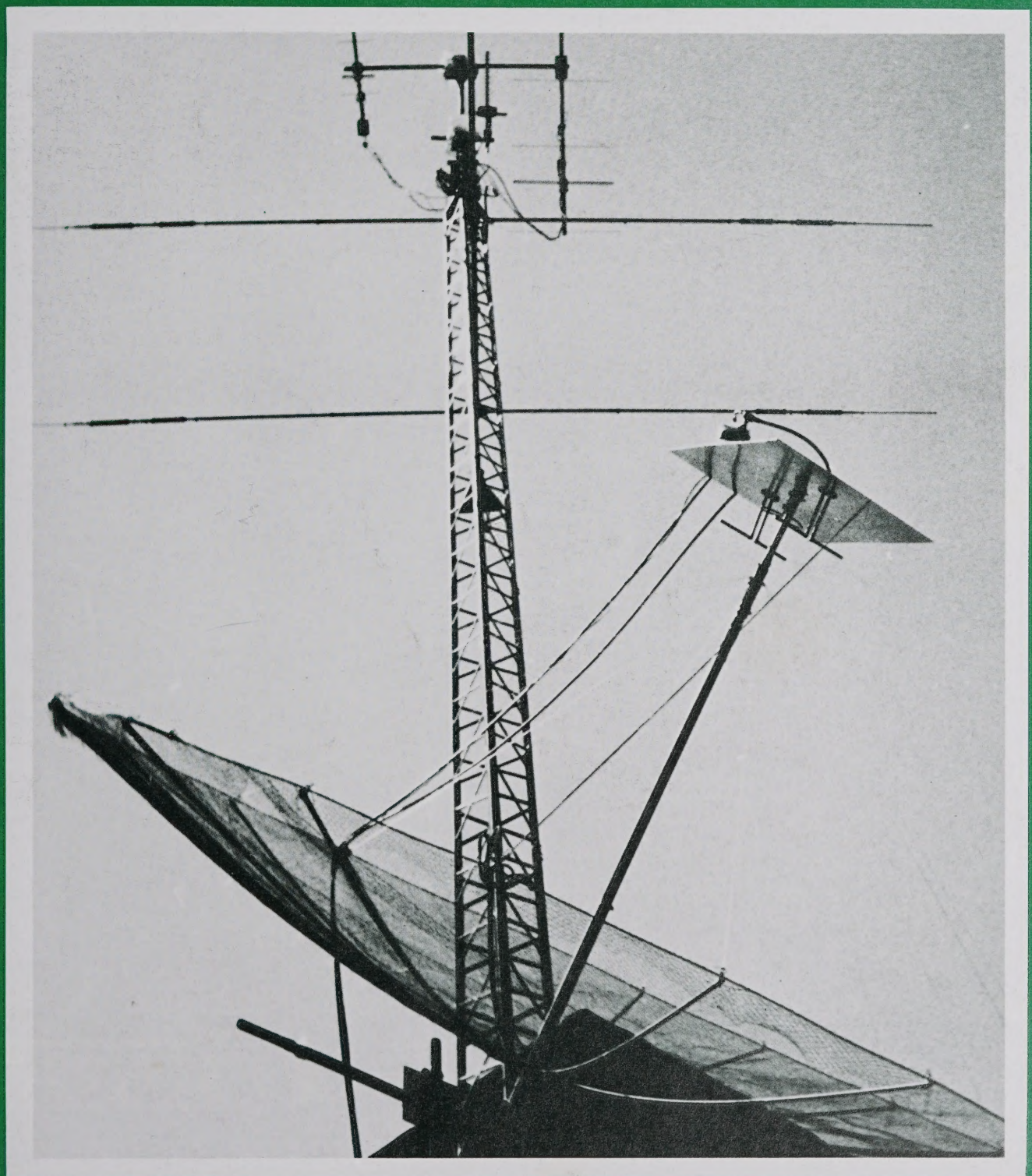
Journal of the Radio Amateur Space Program

April 1985, No. 3



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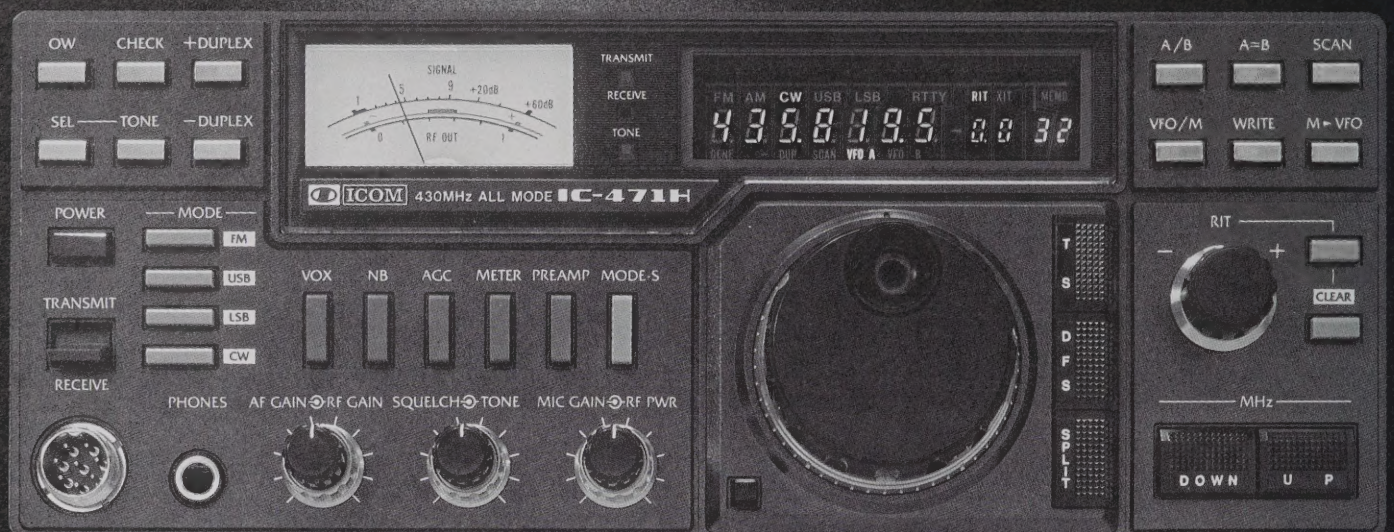

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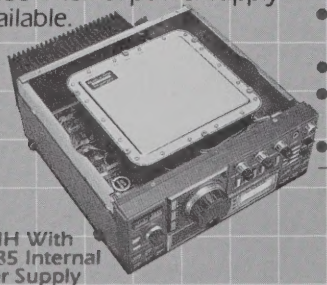

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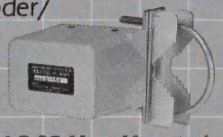

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April 1985, No. 3

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On the cover: The impressive satellite antenna lineup at VE7CLD in Vancouver, BC, Canada includes this homebrew dish for Mode-L operation. Behind the 1269-MHz antenna is Gunter Neugebauer's tower with satellite antennas for 2-meters and 70-cm.

PERSPECTIVE

Many amateur radio leaders correctly view with alarm the declining number of hams in the United States. And although it might not be a problem in other countries, because of its large and influential ham population, a loss in ranks in the U.S. would most certainly have some effect on the rest of the world.

There are some questions that should be asked any time the the size of the amateur population is discussed. First, is the problem real, that is, are we really losing hams? Secondly, if we are experiencing a shrinkage, why did those hams leave our ranks? Finally, if we accept the premise that fewer hams means fewer bands, less equipment, less prestige, and then increasingly fewer bands, what can be done to stop the trend and how can AMSAT help?

Since numbers don't often lie, we must presume that the recently noted shrinkage in our ranks is real and worthy of some countermeasures. True, the amateur population in the U.S. has grown in small amounts to over 400,000, but that figure has declined by a small but disturbing amount in the last year or so. Major organizations, such as the American Radio Relay League, have recognized the decline and have responded with an ambitious program to reverse the trend.

If then the problem is real, why did more people last year abandon amateur radio than enter it? An obvious answer is that they found little to interest them. The promise, for many, may have been greater than the actual experience. Of those, some may truly have found that radio communications just wasn't their thing.

Others may have searched in vain for some meaning or purpose in the jumble of signals on 20 meters, the chatter on 2-meter FM, or the money they spent on expensive transceivers. Yet others may never have reached that stage, leaving the hobby before they ever tapped a key or squeezed a microphone switch. For them, the challenge might have been passing the test, not actually being a ham.

I think it's fair to say that a goodly number simply lost interest and were enticed by other, perhaps more exciting activities. At one time interest in radio communications was high, both for the hobbyist and for the professional. It's significant, perhaps, that fewer young men and women leave engineering school for a career in RF designing now than in years past. At one time "electronics" and "radio" were almost synonymous. In fact, the predecessor to today's Institute of Electronic and Electrical Engineers (IEEE) was called the Institute of Radio Engineers (IRE). But now many companies find it difficult to find young engineers interested in radio communications. Perhaps the thrill and excitement just isn't there as it seems to be in the areas of digital hardware and software designing.

If the downturn is general and not unique to amateur radio, what can we do to stem the receding tide? The answer might be to help make ham radio appealing to a broader range of interests. And what better place to start than in the amateur satellite program? Consider the varied disciplines that must be learned by the satellite enthusiast. Radio communications, to be sure, but also orbital mechanics and prediction (including the use of a computer for that purpose), digital techniques (for packet radio and the future PACSAT satellite), antenna construction and design (since many antennas for satellite bands simply don't exist or are too expensive to buy brand new), homebrewing (leading-edge technology, be it ham or professional, always requires the construction of some piece of station hardware).

In short, the satellite enthusiast has to expend a bit more effort than most hams to pursue his or her interests. But add to that the excitement that comes with being there as radio history unfolds. The users of the PACSAT satellite, for example, will be blazing a new path, not only for ham radio, but for communications in general. When that satellite is launched sometime next year, the world have its first low-cost, digital store-and-forward bird.

There's strength in numbers, especially when dealing with licensing authorities. But the number of hams is small enough already to generally be insignificant in the grand scheme of government operation. Despite our vocal tendencies, it is doubtful we can really make enough noise to stem the onrush of a determined economic entity intent on raiding our bands for more spectrum space. But for our generally well-behaved nature on the bands, our desire to remain a self-policing activity, and many friends in government who understand and appreciate the importance of amateur radio to this country, the avocation might long ago have been stripped of bands and the people needed to populate them.

To do your part, as an AMSAT member, remind your friends of how interesting and exciting satellite communications can be. Call up that friend who disappeared from the air a year ago and give him or her a new reason to remain an active amateur radio operator. Remember that if they drift from the hobby too far, we may never get them back.

Harold Winard, KB2M

Starting Out: A Beginner's Guide

by Andy MacAllister, WA5ZIB*

Since the first issue of Satellite Journal, I have been asked such questions as how to receive the satellites effectively, what to listen for, and how to find your signal on the satellite. Let's take a look at the answers to some of those questions.

The receiving system is the most important part of your satellite station. Your goal should be to put together the best components that can be obtained or built that result in high gain and a low system noise figure. My own experience pointed out the value of such a receive setup. I had, on several occasions, strained to hear casual conversations on AMSAT-OSCAR-10. After talking with those operators it became apparent why they had good reception and I didn't. Their stations were carefully planned with two essential pieces of hardware—good antennas and adequate preamplifiers.

Other experiences showed me how the important front-end of a satellite station can make a big difference. While my dipole or vertical antennas performed quite well for reception of the RS series satellites on Mode A (144 MHz uplink, 29 MHz downlink), for OSCAR-10 I required a 20-element crossed Yagi for consistent operation. I don't have room for larger arrays, but after installing a GaAs FET preamplifier at the antenna, reception improved measurably.

My experiences taught me some basic lessons: Amplify signals at the antenna rather than trying to push them through long lengths of coaxial cable to the shack. If you can't put the preamplifier outside, keep your cable run as short as possible. And if you think expensive antennas are a necessity, think again. Many satellite users do have crossed Yagis set for right-hand circular polarization, but many are using standard Yagis, quads, and helices. There are many homebrew designs that work, so high cost isn't a prerequisite for good performance.

Radio room requirements

Down in the ham shack, I use a 2-meter receive converter along with a general-coverage communications receiver. The combination works well for OSCAR-10 and appears competitive with many of the VHF rigs on the market. It's advantage is that it allowed me to use existing equipment simply with the addition of an inexpensive converter. Since upper sideband is the designated receive mode, I leave my receiver on that setting for voice, CW, and RTTY reception.

To get your signal up to OSCAR-10, you must transmit in the 70-cm band at around 435.1 MHz. Remember that your effective radiated power—the actual RF signal at the antenna multiplied by the antenna's gain—should not exceed 800 W. Roughly, that corresponds to 80 W of RF signal going to a 10-dB gain antenna. On QRP Day, every Monday, the maximum power should not exceed 100 W ERP. Those might sound like formidable power levels, but many good contacts have been made with the 10-W output of a transmit converter, a good beam, and a short run of feedline. A word of caution here. Watch out for cheap cable. Even a 3-dB loss in the feedline represents the waste of half of your transmit converter's output power.

The Mode B transponder on OSCAR-10 is an inverting type, thus if you transmit a signal on lower sideband, say just above 435.1 MHz, you will hear your downlink signal on upper sideband just below 145.9 MHz. Before tuning up, get your transmitter close to the uplink frequency calculated to avoid interference to stations operating on or near your intended receive frequency. For example, if you hear a clear spot at 145.92 MHz, your uplink frequency would be around 435.080. Because two separate frequencies are used, you will be able to operate in full duplex mode and hear your own downlink as you transmit. That's handy to make sure that you have a clear space to use.

The rules are similar for the RS series Mode A satellites. For those birds, your transmit power should not exceed 100 W ERP. Also, unlike the OSCAR satellite, the Russian transponders do not invert your signal. Upper sideband on the uplink yields upper sideband on the downlink. Thus if you wish to make a contact with someone who is listening to RS-8 at 29.49 MHz, your uplink signal would be about 145.99 MHz. The uplink/downlink scheme is not the only thing that's simple about the Russian satellites. Their sensitive receivers make it easy to have many good contacts with antennas as uncomplicated as a ground plane for the uplink and a simple 10-meter dipole for the downlink.

If the Russian birds are for you, check to see if one is active in your area by listening for the Morse code telemetry on the beacon frequencies. If the first frame sent, the so-called K frame, has any number other than 00 in it, the transponder is operating. OSCAR-10's operation is based on a deliberate schedule that is referenced to the mean anomaly, or phase, which defines where the satellite is during the course of its orbit. The mean anomaly ranges from 0 to 255. Thus when the mean anomaly is 0, the satellite is at its lowest point, or perigee, but when the mean anomaly is about 127, the bird has climbed to the top point in its orbit. Monitor nets and AMSAT publications to determine at what point during its travels the satellite will be turned on or will be shut down to conserve its batteries.

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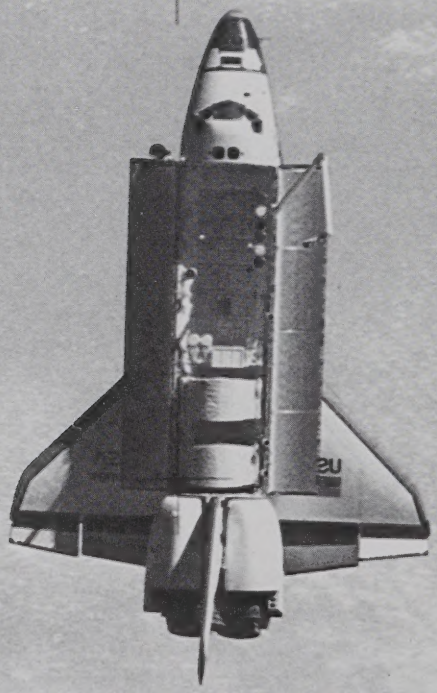

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Worldwide Satellite Operation

by Ray Soifer, W2RS*

Our first item this month comes from none other than Pat Gowen, G3IOR. In September, along with D. Mallett, G3HUL, Pat visited Moscow, where he met with Leo Labutin, UA3CR, and other satellite enthusiasts of the Central Radio Club. Pat mentions that his hosts roled out the "red carpet" for him (pun intended), with a reception complete with vodka and caviar. Pat gave a talk about AMSAT and showed an excellent film detailing the construction, integration, and launch of AMSAT-OSCAR-10. The film, by Werner Haas, DJ5KQ, was followed by a demonstration of satellite tracking software written by John Branegan, GM4IHJ. A question-and-answer session followed, aided by an excellent interpreter, and, according to Pat, "many ideas were discussed—technical, philosophical, and propagational—particularly that of mutual international cooperation in the amateur satellite context."

On Pat's first day in Moscow, the Russian RS-6 satellite died. Pat was at the RS3A command station at the time, after some 12,175 orbits and 19,778 hours of transponder operation. Another satellite, RS-5, apparently is suffering from poor battery conditions, however RS-7 and RS-8 are healthier.

Pat notes that the next Russian amateur satellite, RS-9, has been completed and is now sitting atop Leo's apartment building in Moscow. The flightless bird is under test as a local repeater. It contains two transponders: a Mode A system to translate 2-meter signals to 10 meters and a so-called Mode K transponder that accepts inputs on 15 meters and downlinks then on 10 meters. More about Mode K in the next column.

The Mode A transponder uses an uplink of 145.86 to 145.90 MHz and has a downlink from 29.36 to 29.40 MHz. The beacon will be at 29.402 MHz. A robot transponder will also be provided. RS-9, and a similar companion satellite, RS-10, are now scheduled for launch in December, probably into orbits similar to those of their RS-3 to RS-8 predecessors.

Pat also asks me to remind readers about the Sputnik Net, which meets Saturdays on 14.292 MHz at 1500 Moscow time, or 1100 UTC in the winter and 1200 UTC in the summer. Most conversation is in Russian, but many of the operators are fluent in English and participation by worldwide stations is encouraged. I speak no Russian but have checked into the net several times with a cordial reception.

I have also heard this month from Gordy Wightman, VE5XU, who is the AMSAT columnist for "The Canadian Amateur," the magazine of the Canadian Amateur Radio Federation (CARF). Gordy recently received his QSL card from Enrique Bartolome, EA8CS, to claim the most westerly Mode A WAC in North America. Located in Regina, Saskatchewan at a geomagnetic latitude of 70 degrees north, Gordy has had a half-century of amateur and commercial operating experience with auroral propagation conditions.

What prompted Gordy's letter was a propagation anomaly that occurred several times in early 1984. At those times, the AMSAT-OSCAR-10 2-meter downlink dropped out for up to 8 minutes when his antenna was pointed directly at the satellite. The signal returned when the antenna was pointed obliquely. That prompted Gordy to place his uplink and downlink antennas on separate mounts so that they could be oriented in different directions. With that arrangement in place, the anomaly returned on May 25, 1984, when Gordy was in contact with GM4IHJ.

According to Gordy and John, it appears that the 2-meter downlink was being partially reflected in or about the E layer over Hudson's Bay, a point at which the polar auroral front was believed to have been located at the time. The 70-cm uplink appears to have been unaffected. During the May 25th contact, the great circle path from VE5XU to the satellite was at about 70 degrees azimuth, a point at which the uplink did indeed peak. However, the downlink was virtually nonexistent at that heading but was quite readable when beaming at 30 degrees azimuth. Both Gordy and John noted that the effect might occur at any station north of an arc passing from southern England through Kentucky and northern California.

When unexpected dropouts occur on 2 meters, or the downlink begins to take on the characteristic flutter of auroral propagation, try swinging the downlink antenna up to 60 degrees off the designated tracking azimuth and see where received signals peak. Remember, the same will probably not be true of the uplink, so the effect will not be noticeable on your own signal unless, like VE5XU, your uplink and downlink antennas are capable of independent rotation.

Well, that's it for another month. Don't forget to write!

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FRIDAY, April 26, 1985

Time: 1230 to 1500

Place: Room 3

Welcome—John Browning, W6SP, AMSAT Chairman of the Board.

ACSSB: Amplitude Compandored Single Sideband via AMSAT Satellites—Paul L. Rinaldo, W4RI, Publications Manager, ARRL.

PACSAT: The Packet Radio Satellite Project—Harold Price, NK6K, PACSAT Program Manager, Thomas Clark, AMSAT Director and former President, and Larry Koziel, K8MU, AMSAT Area Coordinator, Michigan.

Advanced Projects and Future Space Programs—Jan King, W3GEY, AMSAT Vice President, Engineering.

ASE: AMSAT Software Exchange—Robert Diersing, N5AHD, AMSAT Software Exchange Manager, Bob McGwier, N4HY, AMSAT Software Exchange Assistant Manager, Martha Saragovitz, Office Manager.

JAS-1: The JAMSAT (AMSAT-Japan) Project to Launch a Voice and Data Communications Satellite into Low Earth Orbit—Harry Yoneda, JA1ANG, AMSAT Board of Directors.

SATURDAY, April 27, 1985

Time: 0900—1100

Place: Room 3

Welcome—Vern Riportella, WA2LQQ, AMSAT President.

Basics: Introductory Concepts and Practices for the Beginner in Satellite Communications—Hans van de Groenendaal, ZS6AKV, President, AMSAT-South Africa, and William McCaa, Jr., K0RZ, AMSAT Area Coordinator, Colorado.

The AMSAT Phase IV Project: A Series of AMSAT Geostationary Satellites—Vern Riportella, WA2LQQ, AMSAT President.

AMSAT Policy Determination—John Browning, W6SP, AMSAT Chairman of the Board.

ASECS: The AMSAT Satellite Emergency Communications System—David Eanes, N4AZI, AMSAT Emergency Communications Manager, and John Champa, K8OCL, AMSAT Acting Vice President, Operations.

SUNDAY, April 28, 1985

Time: 1115 to 1300

Place: Room 3

Welcome—John Champa, K8OCL, AMSAT Executive Vice President.

Basics: Introductory Concepts and Practices for Beginners in Satellite Communications (continued)—Eric Rosenberg, WA6YBT, Jerry Marchal, WA8RYD, AMSAT Assistant Area Coordinators, Southern Ohio.

Questions and Answers—Open Discussion.

Make AMSAT-OSCAR-10 Work for Your Amateur Radio Club—Hans van de Groenendaal, ZS6AKV, President, AMSAT-South Africa.

Satellite Gateway Operations: Linking Your Local Repeater to the AMSAT-OSCAR-10 High-Altitude/Long-Access Satellite—Dave Kifer, N8ETY, AMSAT Area Coordinator, Northeastern Ohio, and Don Knollinger, WB8ZTV, AMSAT Area Coordinator, West Virginia.

Time: 1315 to 1445

Place: Room 1

Welcome—Harold Winard, KB2M, Editor, Satellite Journal.

MARCE: Marshall Amateur Radio Club Experiment in the NASA Get-Away-Special (GAS) Program—Ed Stluka, W4QAU, MARCE Project Director, and Jeff King, WB8WKA, AMSAT Cargo Bay Specialist.

Space Shuttle Missions—William Tynan, W3XO, AMSAT Vice President, Manned Space Flight.

Future Space Station Operations—William Tynan, W3XO, AMSAT Vice President, Manned Space Flight.

Lunar Base Operations: Project Moon Ray—William Tynan, W3XO, AMSAT Vice President, Manned Space Flight.

de K2UBC

by Martin R. Davidoff, K2UBC*

In last issue's discussion of the value of GaAs FET preamplifiers, I questioned how the amateur, with limited resources, could both build and optimize such high-performance station accessories. To answer the question, one will probably have to investigate whether differences in preamplifiers reported by Reisert and Barbari are due to the type of transistor, individual variations when using a single type of transistor, or minor variations in circuitry. It's worth noting, however, that for both of those preamps, tuning for maximum gain produces results that are generally better than those obtained by using silicon transistors in similar circumstances, that is, homebrew preamps tuned for maximum gain.

Several techniques for the homebrewer appear promising. Information presented in the Barbari article suggests that it may be possible to tune for maximum gain at a frequency offset from the operating frequency. That is, if you want to operate at 430 MHz, tune for maximum gain at a frequency 5% higher, for example 450 MHz. Another possible approach, suggested by Alan Katz, K2UYH, Chip Angle, N6CA, and others, is to modify the circuit so that frequencies of maximum gain and minimum noise figure occur closer together. The introduction of a small amount of inductance, in series with the GaAs FET source lead, might accomplish that. Yet another method, useful for those cursed with cable television channels in the 2-meter band, is to insert the preamp in the television RF line and, using just enough signal to produce a marginal, snowy picture, tune for best video. The human eye, plus a video detector operated near its threshold, serve as an excellent optimizing system.

Another important design consideration is the input coupling circuit. As Reisert points out, the input circuit—all circuit elements between the antenna and the gate lead of the FET—has a very important effect on the noise figure. Once we decide to place a preamp at the antenna, the usual conceptual approach of treating the antenna driven element, baluns, cables, and preamp as separate devices should be rethought. The driven element, matching and tuning components . . . in fact everything up to the GaAs FET gate . . . should be considered together. Eliminate all connectors and any feedline that is not necessary for matching. If the antenna driven element uses a balanced feed, consider noise figure when selecting the most effective way of transforming to the single-ended FET input. If the antenna has an unbalanced driven element, as in a group plane, connect the driven element directly to the preamp.

The final design consideration centers around simplifying the circuit and its packaging. Currently, the parts cost for a preamp is mainly determined by the connectors, variable capacitors, and the packaging. The GaAs FET itself now contributes just a small percentage of the total cost of the preamplifier.

Some of the innovative techniques used to homebrew hardline connectors, such as using plumbing fittings and copper pipe, stainless-steel hose clamps, automotive radiator hoses (for weatherproofing), etc., might provide a cost-effective approach to packaging. Similarly, it might be possible to replace expensive, hard-to-find tuning capacitors with simple, home-made devices. For example, a variable capacitor covering a small range can be made by paralleling a homebrew flapper with a short section of rigid microwave coax. Or the inductance of a solenoid can be tweaked to a specific value by compressing turns until the inductance is slightly higher than the desired value. A brass screw, entering the coil, can be used to reduce the inductance.

In sum, preamplifiers featuring GaAs FETs, until recently an expensive accessory used only by a few serious VHF/UHF operators, are quickly becoming a modest-cost necessity. Now that inexpensive GaAs FETs are readily available, it's time for radio amateurs to attack some practical engineering problems related to their use.

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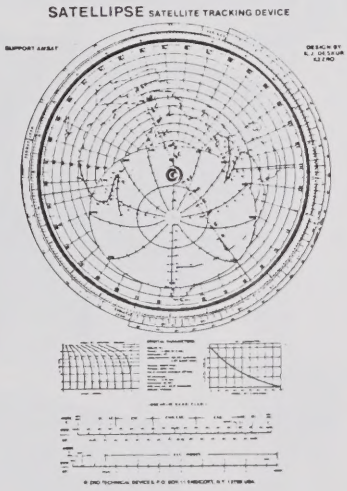

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W 6 Space Philosopher

by John Browning, W6SP, Chairman of the Board*

Most columnists eventually get around to discussing the impact of the microprocessor on their writing tasks. My time has arrived. This text is being typed in my office on a computer utilizing a word-processor program. When it is finished, the processed words will be whisked off through a modem into the telephone line and transmitted via commercial electronic mail to *Satellite Journal* editor, Harold Winard. Harold, in turn, will invoke his own form of digital wizardry. I'll defer to Harold for a description of his part in the process of translating draft zeroes and ones into final print.

My new arrangement represents a significant alteration of past practices. The earliest attempts at Space Philosopher were generated on a portable electric typewriter. The extent of disuse to which the typewriter has been relegated is clear testimony to my preference for more modern equipment. My writing hasn't improved. My attitude has.

Forty-five years ago, while attending high school in Terra Alta, West Virginia, I became highly motivated to enroll in a typing class. The motivation was derived from a casual observation—all of the typing students were girls. The only alternative was Home Economics so the final curriculum selection was an easy one.

Once the class got underway, a problem developed. The word 'macho' had not yet found its way to the Appalachians. But in spite of our ignorance of Spanish, all of us country boys knew we were superior to girls. Typing grades were determined by tests of speed and accuracy. Staying at the head of the class became a daily challenge. By the end of the semester, I had proved I could make mistakes at a higher rate than any of my young lady competitors. Home Economics was looking better and better.

Actually, I benefited from the experience in a couple of important ways. I was able to start my struggle through life with both an ordinary portable typewriter and the most attractive of my classmates at my side.

The classmate endures as a charming companion who often allows me to do her business typing. The typewriter has been discarded. The transformation was initiated at the AMSAT Board of Directors meeting in late 1982. Pat Gowan, G3IOR, took the occasion to note that W6SP was the only board member who did not own a computer. To correct the situation, he presented me with one. The nameplate read 'LOTUS-FLOWER BRAND, MADE IN THE PEOPLE'S REPUBLIC OF CHINA.' I had become the owner of a genuine imported abacus.

The implied message was clear.

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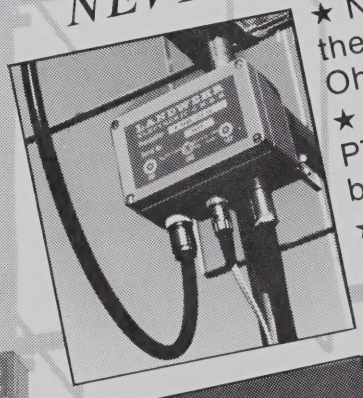

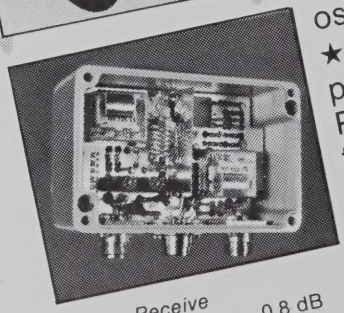

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Such raw peer pressure is impossible to ignore. Those of us who are supposedly at the forefront of communications technology should be moving into the twentieth century. It's never too late to do better! Even so, a prudent individual should proceed cautiously within carefully thought-out guidelines. Such as 1.) acquire a personal computer, 2.) become an appliance operator only and, 3.) use the computer exclusively as a time-saving tool. It all sounded very straightforward. Within one week of initiating action to comply with the first guideline, I was ready to stick with the abacus.

There are two obvious ways for a novice to establish his hardware and software requirements. He can consult with experts and he can read technical publications. A large obstacle immediately blocked these courses of action. In my advanced state of computer illiteracy, I couldn't speak or read the language. I was too dumb to ask dumb questions. However, it soon became apparent that computer users have strong and contradictory biases regarding the superiority of their own installations. Most have experience with only one system so everybody is happily convinced he has the best computer, software, printer, and modem combination available. Sidestepping this whole, complex issue, I took the plunge and acquired, from a friend, the system that seemed to provide the most bytes for the bucks on hand. I must have chosen wisely for I immediately possessed the best computer, software, printer, and modem combination available. And after just a few days use of my new system, I became completely capable of asking truly impressive dumb questions.

My biggest current challenge is to remain an appliance operator in the new world of computer jargon. It is a lot like trying to ignore the girls in typing class. Computers are fun! Wouldn't it be swell to be able to modify the software so it would take care of my needs completely? Or even write my own programs? Think of the thrill of being called a 'hacker' by the digital wizards of the world! And why do everything commercially? Eventually, I might even be able to wire up a terminal node controller board and burst the column to Harold through my OSCAR station over PACSAT. Or perhaps come up with a design for a new modem to increase the satellite transmission bit rate for amateurs all over the globe.

By returning to reality, I can easily identify the greatest advantage of my new life in the microprocessor world. It is the achievement of complete freedom from worry about making typographical errors. I can now rattle off words at a fantastic rate while floating along in a mode of sheer serenity. At leisure, I glance at the monitor screen and quickly repair my initial damage to the language. When the document is completed, a spelling-checker program can verify my competence. It's easy to stay at the head of the class. There is one little psychological hang-up remaining to be overcome. I keep looking up words in a battered old dictionary to prevent the computer from catching me in spelling mistakes!

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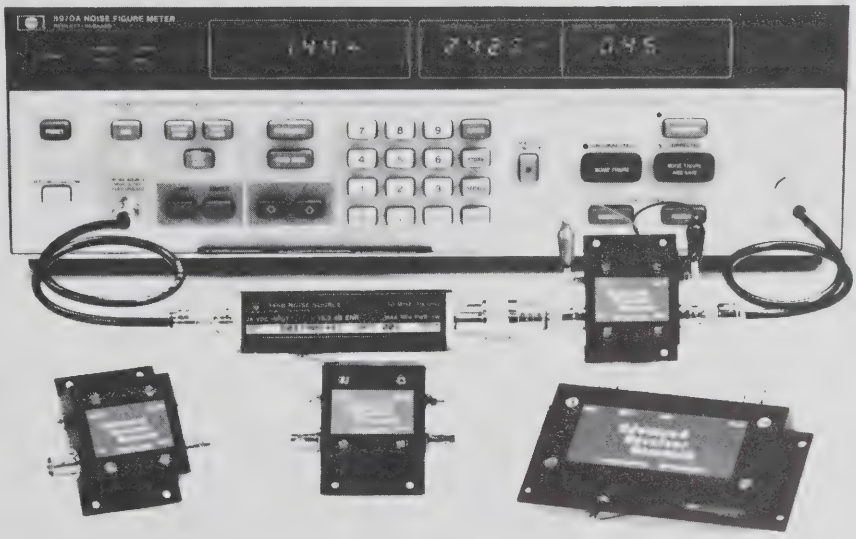

Receive Only	Freq. Range (MHz)	N.F. (dB)	Gain (dB)	1 dB Comp. (dBm)	Device Type	Price
P28VD	28-30	<1.1	15	0	DGFET	$29.95
P50VD	50-54	<1.3	15	0	DGFET	$29.95
P50VDG	50-54	<0.5	24	+12	GaAsFET	$79.95
P144VD	144-148	<1.5	15	0	DGFET	$29.95
P144VDA	144-148	<1.0	15	0	DGFET	$37.95
P144VDG	144-148	<0.5	24	+12	GaAsFET	$79.95
P220VD	220-225	<1.8	15	0	DGFET	$29.95
P220VDA	220-225	<1.2	15	0	DGFET	$37.95
P220VDG	220-225	<0.5	20	+12	GaAsFET	$79.95
P432VD	420-450	<1.8	15	−20	Bipolar	$32.95
P432VDA	420-450	<1.1	17	−20	Bipolar	$49.95
P432VDG	420-450	<0.5	16	+12	GaAsFET	$79.95
Inline (rf switched)						
SP28VD	28-30	<1.2	15	0	DGFET	$59.95
SP50VD	50-54	<1.4	15	0	DGFET	$59.95
SP50VDG	50-54	<0.55	24	+12	GaAsFET	$109.95
SP144VD	144-148	<1.6	15	0	DGFET	$59.95
SP144VDA	144-148	<1.1	15	0	DGFET	$67.95
SP144VDG	144-148	<0.55	24	+12	GaAsFET	$109.95
SP220VD	220-225	<1.9	15	0	DGFET	$59.95
SP220VDA	220-225	<1.3	15	0	DGFET	$67.95
SP220VDG	220-225	<0.55	20	+12	GaAsFET	$109.95
SP432VD	420-450	<1.9	15	−20	Bipolar	$62.95
SP432VDA	420-450	<1.2	17	−20	Bipolar	$79.95
SP432VDG	420-450	<0.55	16	+12	GaAsFET	$109.95

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AMSAT NEWS

Phase IIIC Plans Revealed

The Phase IIIC satellite, now under construction in Washington, DC and Boulder, Colorado, will contain four communications transponders, including one with a downlink at 2.4 GHz. Plans for the satellite were reported recently by Jan King, W3GEY, AMSAT's vice president for engineering.

According to King, the first transponder will be a Mode B type similar to the one carried by AMSAT-OSCAR-10. The uplink will be in the 70-cm band and the downlink will in the 2-meter band. The passband, which will be about 180 kHz wide, will be removed from that used by OSCAR-10 to reduce interference. The actual transponder used might be the flight spare kept as a backup unit for OSCAR-10.

The second transponder will be a type tentatively dubbed Mode JL and will receive signals from both the 2-meter and 24-cm bands and transmit them at 70-cm. Approximately 50 kHz of the 2-meter band would either overlap or be placed adjacent to the downlink resulting from the 24-cm uplink. The L-band downlink would have an 800-kHz bandwidth and use an improved, high-efficiency HELAPS amplifier.

A Model L packet transponder, favored by a new group in West Germany, would handle frequency-shift keyed (FSK) data at speeds of 2400 bits/s on the uplink and 400 bits/s on the downlink. The fourth transponder would be used for a single FM signal, approximately 20-kHz wide, arriving at the satellite in the 70-cm band and returning to Earth at 13 cm. The L-band transmitter would deliver 2 W.

Plans for use of a plasma kick motor to boost the Phase IIIC satellite into a higher orbit have apparently been scrapped. Instead, a bipropellant motor, similar to that used for OSCAR-10, will be used. However, the specific impulse of the West Germany manufactured motor is expected to be 10% greater to compensate for the additional mass of the Phase IIIC spacecraft.

Plans now call for a mid-1986 launch by the European Space Agency from their facility in Korou, French Guyana. That date is expected to slip several months.

New Area Coordinators Named

New Area Coordinators announced by Chief Area Coordinator Jack Somers, WA6VGS, are Robert Dalleske, W6AMW (northern California); Ross Forbes, WB5GFJ, (north central California); Cliff Buttschardt, W6HDO (south central California); Harry Bluestein, N6TE (south southern California) and (rejoining the staff) Bud Schultz, W6CG (southern California).

Coordinator Receives Award

The Arrow Communication Association of Ann Arbor, Michigan, has awarded AMSAT's Michigan Area Coordinator Larry Koziel, K8MU, a Special Service Award for his public relations efforts on behalf of AMSAT, packet radio, and the PACSAT project. The Award was made late last year in Ann Arbor.

Member Recruitment Drive Winners Claim Prizes

The winners of the member recruitment drive signed up more than 150 new members during the contest period. The top finishers and their prices were:

1. N3CEG 26 points (An FT-726R transceiver donated by AMSAT)
2. KA1M 20 points (A Dynetic dual axis rotator donated by Dynetic Systems)
3. N8ETY 11 points (An ARR in-line 2-meter GaAs FET preamp donated by ARR)
4. WA5ZIB 10 points (A Mirage D1010N 70-cm amplifier donated by Mirage)
5. WA6VGS 6 points (A Landwehr mast-mounted 2-meter GaAs FET preamp donated by Henry Radio)
6. WA2LQQ 5 points (Disqualified self)
6. K8OCL 5 points (Tied with WA2LQQ, WA2LJM. Selection pending)
6. WA2LJM 5 points (Tied with K8OCL, WA2LQQ. Selection pending)
8. Dick Ruhr 4 points (Tied with Paul Beeman and WB5PMR; pending)
8. Paul Beeman 4 points (Tied with WB5PMR and Dick Ruhr; pending)
8. WB5PMR 4 points (Tied with Dick Ruhr, Paul Beeman; pending)

Tapes Available From Video Library

The AMSAT Video Tape library, operated for AMSAT by Roger Johnson, WBØGAI, was recently augmented by a series of video tapes recorded at last year's Second Annual Radio Amateur Satellite Symposium in Los Angeles, California. The tapes are available for loan to groups and interested amateurs. The tapes include:

#10—Introduction to the Symposium; Advanced Gateway Concept by Dr. Al Dayton, KA4JFO; JAS-1 by Harry Yoneda, JA1ANG; Project Companion (ACSSB) by Paul Rinaldo, W4RI and Jim Eagleson, WB6JNN.

#11—Computers and Satellites by Bob Diersing, N5AHD; OX3FS Memorial Presentation to Dr. Bob Leonard, KD6DG, by Vern Riportella, WA2LQQ; Solar Sail Project by Mark Bergham, Robert Staehle and Chauncey Uphoff.

#12—PACSAT Forum with Harold Price, NK6K, Wally Lindstruth, WA6JPR, Rick Fleeter, WA8VGK, Phil Karn, KA9Q, and Martin Sweeting, G3YJO; Sat-

ellite Economics by Dr. Tom Clark, W3IWI; Ham-In-Space Activities (Space Shuttle) by Bill Tynan, W3XO.
#13—Phase IV and Future Projects by Vern Riportella, WA2LQQ
#14—The UoSAT-2/OSCAR-11 story. A brief account of the development and launch of the latest OSCAR, with an intriguing audio accompaniment.

At present, the tapes are available in VHS format only. They are available on loan for three weeks for $6.00 per tape. A check for the fee plus a second refundable deposit check for $25.00 should accompany each request. Mail orders or inquiries to: AMSAT Video Tape Library, % WBØGAI, 1627 36th Ave Court, Greeley, CO 80634.

Earlier tapes (#1 through #9) continue to be available. Send a stamped, self-addressed envelope for complete listing.

Two-Meter QRM Threatens OSCAR Operations

Distressed satellite users are reporting an upsurge in inadvertent interference to satellite operations. In many areas of the country, 2-meter operators are working within the 145.800-to-146.000-MHz band segment designated by gentlemen's agreement to OSCAR use. Mode A uplinks and Mode B downlinks both occupy that limited territory. Satellite users themselves may inadvertently be adding to the QRM by conducting terrestrial conversations when a satellite is out of view.

N2CF Moves To New ARRL Post

AMSAT's General Manager/Executive Director Bill Lazzaro, N2CF, has stepped down from his post as a paid employee effective January 18, 1985. In his statement to the AMSAT Board of Directors, Bill said he feels he has accomplished many of the tasks he set out to do when he assumed his present post and that the position can best be staffed now on a volunteer basis. Bill indicated he wishes to continue in that volunteer capacity.

Lazzaro has accepted a new position with the American Radio Relay League (ARRL) and assumed his new responsibilities on January 21. He is now the Development Manager for the ARRL and works from an office in Washington DC. The post was recently created in response to the ARRL Board's decision to develop an aggressive membership growth program.

In 1983, Bill moved to Mt. Airy, Maryland, a Washington D.C. suburb, to assume the AMSAT post. He will be joined in the ARRL Washington office by League General Counsel Chris Imlay, N3AKD, a law clerk, and a clerical staff. Perry Williams, W1UED, spends several days per week working from the Washington office as well.

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The Software is available separately. Its clear graphics make it an addition to any shack.

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Early 85—IBM, Apple, TRS-80, Atari

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CIRCLE 66 ON READER SERVICE CARD

The Digital Front

by Harold Price, NK6K*

In this issue: PACSAT team meets at VITA headquarters and NK6K and G3YJO's chilling escape from Washington, DC.

There we were—Martin, G3YJO, Phil, KA9Q, and Harold, NK6K—three pilgrims on a journey to pay our respects to and seek a blessing from the OSCAR 1 backup satellite on display at the National Air and Space Museum in Washington, DC. Alas, that was not to be. The Hall of Satellites had been temporarily replaced by an only slightly less important symbol of times past—the Spirit of St. Louis. With our airport departure times rapidly approaching, NK6K and G3YJO placed themselves in the hands of one of AMSAT's best navigators, KA9Q, who had driven his own car to the meeting. In his previous attempt, KA9Q, with data from several ground stations around the world, had computed the height of AMSAT-OSCAR-10 to within 3 km, an error of just 0.01%! This time, half an hour and several orbits of Georgetown later, we were to learn that the 3-km figure seemed to apply more than the 0.01% figure. Even a hastily rigged intertial navigation system, using a precision $2.50 gyroscope purchased by Martin in the museum's souvenir shop didn't help. In all fairness, the problem was not one of navigation but one of "You can't get there from here." The local constabulary was out in force to ensure that the "No Left Turn" signs were obeyed.

With our departure window rapidly closing and our estimated position still off the edge of our only map, the engine died. While Martin was getting a lesson in American sign language from the driver behind us, I flagged down a cab, made the arrangements, grabbed Martin, and we headed to the airport.

In a typical AMSAT happy ending, we got to our planes on time, and Phil got his car running and back to New Jersey.

Why were we in Washington? Glad you asked. . . .

A PACSAT meeting.

A PACSAT design review was held in Washington, D.C. on March 9, 10, and 11 at the headquarters of Volunteers in Technical Assistance (VITA), a co-sponsor of PACSAT. It was the last major review before we enter the final system definition and prototyping phase. Several system concepts for PACSAT have been proposed, discussed, modified, adopted, or discarded since the original idea was put forth in 1982. The major factor— the exact amount of volume inside a NASA STS Get-Away- Special can with satellite deployment mechanism, was not known until Monday afternoon, March 11.

Based on that figure, and other information gathered and discussed at the meeting, everyone is now convinced that it is possible and well within our technical capability to launch a digital store-and-forward mailbox device. The satellite would have a memory of greater than 4 Mbytes and would be boosted first into a standard shuttle orbit and then raised to a long-life communications orbit using an electro-thermal propulsion system.

Although the exact specifications can not be published until the end of the next 3-month definition phase, the following are likely parameters:

Launcher: The Space Shuttle. PACSAT would ride in a 20-by-31-in. cylinder can that is closed at both ends and loaded in the orbiter payload bay. The top is hinged and can be opened remotely. The satellite would be attached to a 10 in. high pyramid structure by the same type of clamp band used in previous OSCAR missions, most recently UoSAT OSCAR II. At deployment time, explosive bolt cutters would open the clamp band. A spring would push PACSAT out of the can at a rate of one meter per second.

Size: An octagonal cylinder measuring 50.8 cm high and 48.26 cm in diameter.

Weight: 40 kg dry, that is, not including propellant.

Propulsion: Electro-thermal. A cold gas is heated before exiting through a thruster.

Propellant: 16 liters of ammonia (NH3).

Orbit: Polar is first choice. That depends on the availability of launches carrying GAS payloads from Vandenburg Air Force Base. It will be several months before that is known. Therefore, PACSAT must be designed to handle the different thermal and solar power parameters of the 57-degree inclination orbit resulting from a Kennedy Space Flight Center launch.

Altitude: 500-800 km, depending on the altitude at time the satellite is released from the orbiter, as well as the final volume available for propellant.

Uplinks and Downlinks: Still unknown. PACSAT will primarily use 2 m and 70 cm. The most likely configuration will be 70 cm up and 2 m down, although a 2 m up and 70 cm down mode might be available as a backup if there is sufficient room.

Modulation: The OSCAR-11 research currently underway, has demonstrated a capability of 2400 bauds using an MSK-like system. Development of a 9600-baud PSK system is still under way, and will be used if it is available in time.

Protocol: The basic access protocol will be AX.25. Standard terminal node controller (TNC) software will be sufficient to "read the mail" and gather telemetry. A higher level protocol will be required to enter data into the system. That software will run on a computer attached to a standard TNC. Software will be produced for generic CP/M and MS-DOS systems.

Ground station: Regardless of the final modulation scheme, an RF modem will be designed that attaches to the "modem disconnect" connector on the TAPR, AEA, Heathkit, and any other compatible TNCs. That unit will be self-contained, requiring only a power input, the connection to a TNC, and an antenna.

* *1211 Ford Avenue Redondo Beach, CA 90278*

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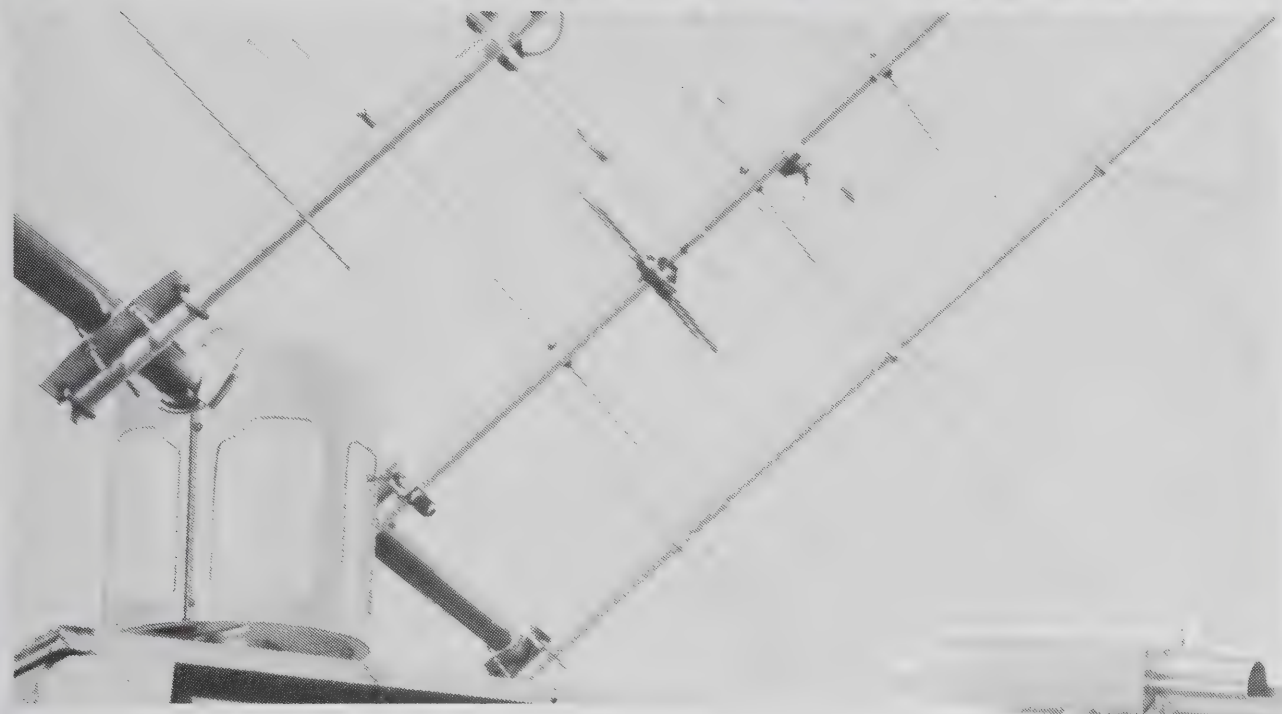

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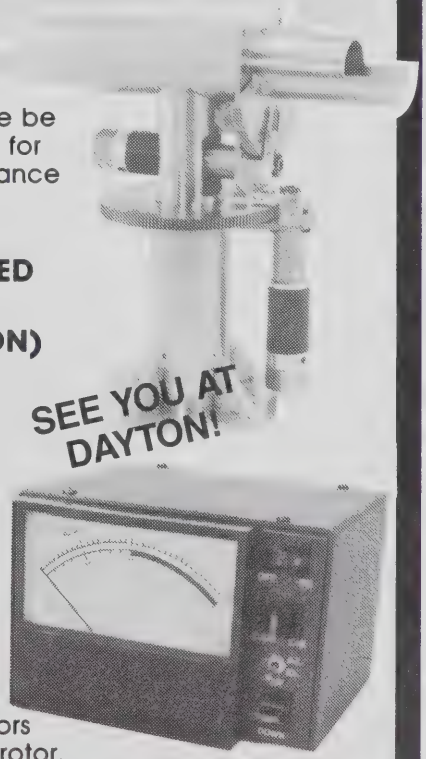

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Orbital Elements

Satellite: oscar-9

Catalog number:	12888	
Epoch time:	85052.15431026	
	Thu Feb 21 03:42:12.406	1985 UTC
Element set:	734	
Inclination:	97.6206	deg
RA of node:	37.2521	deg
Eccentricity:	0.0002079	
Arg of perigee:	355.7450	deg
Mean anomaly:	4.3844	deg
Mean motion:	15.26989174	rev/day
Decay rate:	1.47e-05	rev/day^2
Epoch rev:	18752	
Semi major axis:	6859.921	km
Anom period:	94.303223	min
Apogee:	483.318	km
Perigee:	480.465	km
Ref perigee:	2608.15351268	
	Thu Feb 21 03:41:03.495	1985 UTC
Beacon:	145.825	MHz

Satellite: oscar-10

Catalog number:	14129	
Epoch time:	85055.81351891	
	Sun Feb 24 19:31:28.33	1985 UTC
Element set:	162	
Inclination:	26.0672	deg
RA of node:	151.3504	deg
Eccentricity:	0.5990479	
Arg of perigee:	351.0336	deg
Mean anomaly:	1.8484	deg
Mean motion:	2.05855313	rev/day
Decay rate:	−2.9e-07	rev/day^2
Epoch rev:	1281	
Semi major axis:	26105.553	km
Anom period:	699.520444	min
Apogee:	35365.985	km
Perigee:	4089.032	km
Ref perigee:	2611.81102471	
	Sun Feb 24 19:27:52.534	1985 UTC
Beacon:	145.8100	MHz

Satellite: oscar-11

Catalog number:	14781	
Epoch time:	85051.22662318	
	Wed Feb 20 05:26:20.242	1985 UTC
Element set:	57	
Inclination:	98.2082	deg
RA of node:	118.2460	deg
Eccentricity:	0.0012191	
Arg of perigee:	229.5884	deg
Mean anomaly:	130.4257	deg
Mean motion:	14.61945915	rev/day
Decay rate:	−2.5e-07	rev/day^2
Epoch rev:	5194	
Semi major axis:	7062.113	km
Anom period:	98.498856	min
Apogee:	704.723	km
Perigee:	687.504	km
Ref perigee:	2607.20184158	
	Wed Feb 20 04:50:39.112	1985 UTC
Beacon:	145.8260	MHz

Satellite: rs-5

Catalog number:	12999	
Epoch time:	85054.26819137	
	Sat Feb 23 06:26:11.734	1985 UTC
Element set:	220	
Inclination:	82.9602	deg
RA of node:	6.8376	deg
Eccentricity:	0.0009750	
Arg of perigee:	311.2350	deg
Mean anomaly:	48.7873	deg
Mean motion:	12.05058932	rev/day
Decay rate:	4e-08	rev/day^2
Epoch rev:	14018	
Semi major axis:	8033.815	km
Anom period:	119.496231	min
Apogee:	1675.415	km
Perigee:	1659.749	km
Ref perigee:	2610.25694542	
	Sat Feb 23 06:10:00.84	1985 UTC

Satellite: rs-7

Catalog number:	13001	
Epoch time:	85056.23688768	
	Mon Feb 25 05:41:07.95	1985 UTC
Element set:	192	
Inclination:	82.9565	deg
RA of node:	1.2332	deg
Eccentricity:	0.0020829	
Arg of perigee:	228.1513	deg
Mean anomaly:	131.7764	deg
Mean motion:	12.08691800	rev/day
Decay rate:	4e-08	rev/day^2
Epoch rev:	14084	
Semi major axis:	8017.699	km
Anom period:	119.137070	min
Apogee:	1667.942	km
Perigee:	1634.542	km
Ref perigee:	2612.20660324	
	Mon Feb 25 04:57:30.519	1985 UTC

Satellite: rs-8

Catalog number:	12998	
Epoch time:	85033.43517227	
	Sat Feb 2 10:26:38.884	1985 UTC
Element set:	310	
Inclination:	82.9573	deg
RA of node:	20.5848	deg
Eccentricity:	0.0020315	
Arg of perigee:	43.9804	deg
Mean anomaly:	316.2868	deg
Mean motion:	12.02953923	rev/day
Decay rate:	4e-08	rev/day^2
Epoch rev:	13743	
Semi major axis:	8043.191	km
Anom period:	119.705333	min
Apogee:	1691.543	km
Perigee:	1658.863	km
Ref perigee:	2589.44526622	
	Sat Feb 2 10:41:11.1	1985 UTC

Via Phil Karn, KA9Q

AMSAT National Coordinators

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(Continued next page)

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Membership Survey

Final Tabulation of 1984 Membership Survey—Combined Life and Regular Member Results. The Figures Below Are The Total Number of Responses to Each Item.

AMSAT Management wants to know what you think about some important issues. Please take a moment to answer the following questions and return this form with your ballot.

My Membership Classification is: (Check one) _X_ Regular _X_ Life _X_ Sustaining Life

I. I am an AMSAT member PRIMARILY because: (Check one)

a. 1222 I support the construction of OSCAR satellites which I use or intend to use OR b. 141 I want to receive *Orbit* magazine and other member services

II. Please rank the following *Orbit* magazine content areas in order of desirability, with #1 being the most desirable and #6 being the least desirable.

a. 32 editorial
b. 233 orbital information
c. 169 operating news
d. 567 technical articles
e. 157 beginner articles
f. 118 AMSAT news

If you chose "a" above, would you continue your AMSAT membership if *Orbit* became a black and white, non-glossy publication?
157 Yes 6 No

III. Which would you prefer (Check one)

a. 178 *Orbit* magazine with a color cover on glossy paper (as it is now) and receive it on the current basis OR b. 1057 *Orbit* magazine with a black and white cover, on non-glossy paper, but receive it more often

IV. We must raise a minimum of $100,000 for the launch of our Phase 3C satellite which is scheduled for early 1986. IN ADDITION TO YOUR MEMBERSHIP DUES, how much money would you be willing to contribute each year, exclusively for OSCAR satellite development and projects? (Check one)

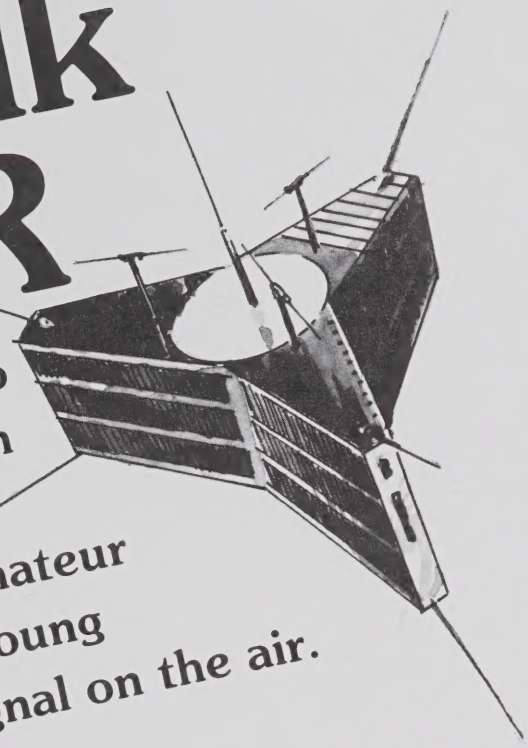
154 $0 303 $11-20 171 $35-50 59 $100-200 270 $1-10 299 $21-35 125 $51-100 8 more than $200

V. Bearing in mind that any membership dues spent on *Orbit* magazine are funds which are not spent on projects, which would you prefer (Check one)

a. 280 I'd rather continue to receive *Orbit* magazine the way it is now, without any changes in its appearance or quality OR b. 1075 I'd rather receive an inexpensive *Orbit* newsletter and have more of my dues go to projects

If you chose "a" above, would you continue your AMSAT membership if *Orbit* became a newsletter? 141 Yes 27 No

We talk OSCAR



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- ★ AZMUTH & ELEVATION ROTORS
- ★ GaAsFET RECEIVING PREAMPS
  - STANDARD
  - MAST MOUNTED
- ★ L & R HAND CIRCULAR POLARIZED ANTENNAS
- ★ ORBIT PLOTTERS
- ★ ORBIT MAGAZINE
- ★ AMSAT BADGES
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TR-9130

TR-9130 2 meter all mode

The TR-9130 is a compact rig that gives you 25 watts of RF power on all modes!! You can select your tuning steps from 100-Hz, 1-kHz, 5-kHz or 10-kHz. With six memories, you can program your favorite frequencies! (FM 1-5 Simplex or ±600-kHz offset, memory 6 non-standard offset, all six for simplex, any mode!) Dual digital VFO's, and transmit frequency tuning enhance OSCAR operations.

Internal battery back-up (9 V Ni-Cd not Kenwood supplied) retains memories for approximately 24 hours, in case you operate mobile and base!

Other convenient features such as automatic band scan, squelch circuit for FM/SSB/CW, tone switch, repeater reverse switch, CW semi break-in; sidetone, high performance noise blanker HI (25) LOW (5) power switch (FM/CW) RF gain control, and RIT circuit further enhance this expressive package!

Optional accessories:

- KPS-7A AC power supply.
- PS-20 AC power supply (TR-9500 only).
- [illegible]-9A system base with memory back-up supply.
- SP-120 external speaker.
- TK-1 AC adapter for memory back-up.
- SP-40 mobile speaker.
- SP-50 mobile speaker.
- SW-100 A/B power meters.
- MC-55 Mobile Mic w/time-out timer.

TR-9500

70 CM SSB/CW/FM transceiver

- Covers 430-440 MHz, in steps of 100-Hz, 1-kHz, 5-kHz, 25-kHz or 1-MHz.
- CW-FM Hi—10 W, Low—1 W. SSB 10 W.
- Automatic band/memory scan. Search of selected 10-kHz segments on SSB/CW.
- 6 memory channels.

TS-711A/TS-811A

Multi-function all-mode 2 m and 70 cm transceivers.

The TS-711A 2 m (142-149 MHz) and TS-811A 70 cm (430-450 MHz) all-mode transceivers are perfect base station units, designed to complement your present HF station. Both feature Kenwood's innovative D.C.S. circuitry. Built-in dual digital VFO's provide commercial-grade frequency stability through the use of a TCXO (Temperature Compensated Crystal Oscillator). The new fluorescent multi-function display shows frequency, RIT shift, VFO A/B, SPLIT, ALERT, repeater offset, digital code, call sign code, and memory channel. 40 multi-function memories store frequency, mode, repeater offset and tone. They have programmable scan, memory scan, and mode scan. The Auto-mode function automatically selects the correct mode for the frequency being used. When a mode key is depressed, an audible "beeper" announces mode identification in International Morse Code.

The TS-711A/TS-811A also feature all-mode squelch, noise blanker, speech processor (SSB, FM), IF shift, RF power control, alert, and a unique channel Quick-Step tuning that varies tuning characteristics from conventional VFO feel, to stepping action when CH.Q switch is depressed.

Combine all these features with built-in AC power supply and a hefty 25 watts RF output power and you have your ideal base station.

Optional accessories:

- CD-10 Call sign Display
- TU-5 CTCSS Tone Unit • VS-1 Voice Synthesizer • MC-60A Deluxe Desk Mic • MC-80 Desk Mic • MC-85 Desk Mic
- SP-430 External Speakers
- MB-430 Mobile Mount
- PG-2J DC Cable